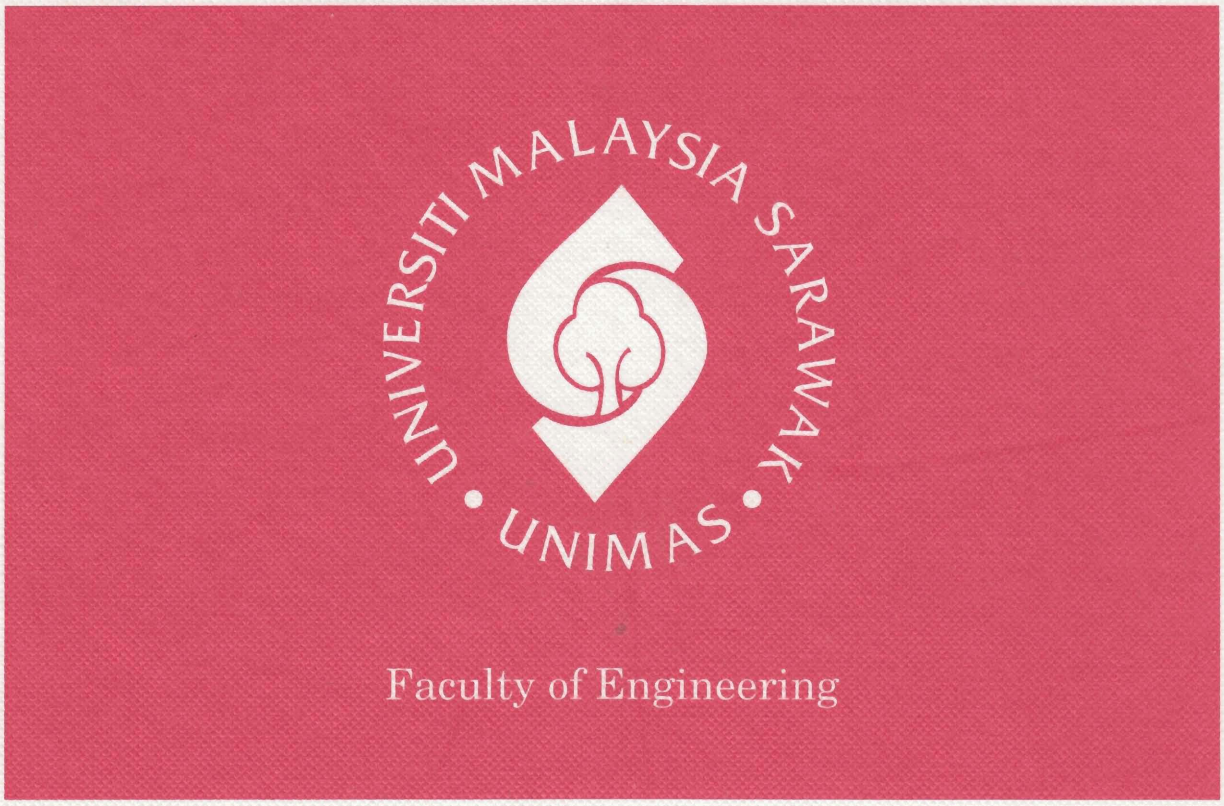

DESIGN OF A WATER RETICULATION SYSTEM FOR PROPOSED DESA ILMU PHASE 15, 18 AND 19 HOUSING SCHEME AT SAMARAHAN LAND DISTRICT, SARAWAK

Eugene Chanel Anak Jimbap

Bachelor [illegible] Engineering with Honours
Civil Engineering)
2006

UNIVERSITI MALAYSIA SARAWAK

R13a

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SESI PENGAJIAN: 2005/2006

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Tarikh: 11th May 2006

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Final Year Project Report below:

Title : Design of a Water Reticulation System for Proposed Desa Ilmu Phase 15, 18, and 19 Housing Scheme at Samarahan Land District, Sarawak

Author : Eugene Chanel Anak Jimbap

Matric No. : 8162

has been read and certified by:

12 June 2006

Puan Rosmina Ahmad Bustami — Date

(Supervisor)

DESIGN OF A WATER RETICULATION SYSTEM FOR PROPOSED DESA ILMU PHASE 15, 18 AND 19 HOUSING SCHEME AT SAMARAHAN LAND DISTRICT, SARAWAK

EUGENE CHANEL ANAK JIMBAP

This project is submitted in partial fulfillment of the requirements for the degree of
Bachelor of Engineering with Honours
(Civil Engineering)

Faculty of Engineering
UNIVERSITI MALAYSIA SARAWAK
2006

Specially dedicated to my beloved family and friends,
thanks for everything...

ACKNOWLEDGEMENT

The student wishes to express greatest thanks to the supervisor of Final Year Project, Puan Rosmina Ahmad Bustami for her encouragement, guides, and advices in carried out this project.

Special thanks to Desa Ilmu Sdn. Bhd., especially to the Project Manager, Mr.Joseph Fang and also Mr. Gary Kho, Mr. Edwin Chandra, and Mr. Colin Leong for giving a chance to student to do a design on the project. Also special thanks to the engineer of Jurutera Minsar Consult Sdn. Bhd., Miss Sharon Yee for providing information needed for the project.

ABSTRACT

Three major component of environment are atmosphere, hydrosphere, and lithosphere. Hydrosphere is a water component consists of oceans, lakes, and rivers which covered almost 73% of the earth surface. Human body contains about 70% of water that shows the importance of water in sustaining our life. Besides that, water also affects our daily activities. A water distribution system is required to transport water from sources to consumers or users. This phenomenon requires the water distribution system to be designed perfectly. The system must be able to provide consistently adequate quantity of water to users at an acceptable pressure as economically as possible. This project is about to design a water reticulation system for proposed Desa Ilmu Phase 15, 18, and 19 housing scheme at Samarahan Land District. The design is based on Malaysia Jabatan Kerja Raya (JKR) Standards that was stated in The Malaysian Water Association (WMA) Design Guidelines for Water Supply Systems (1994). The pipelines network analysis for the project are analyze using WaterCAD software that developed by Haestad Methods Inc. USA. The system is analyzed using steady-state simulation in three different scenarios; average daily demand, peak consumption, and critical demand during fire.

ABSTRAK

Tiga komponen utama alam sekitar adalah atmosfera, hidrosfera, dan litosfera. Hidrosfera adalah unsur air yang terdiri daripada lautan, tasik, dan sungai dimana ia merangkumi hampir73% daripada permukaan bumi. Badan manusia mengandungi kira-kira 70% air, ini membuktikan bahawa pentingnya air dalam kehidupan kita. Selain daripada itu, air juga memberi kesan kepada aktiviti harian kita. Sistem pengagihan air adalah diperlukan untuk membekalkan air dari punca kepada pengguna. Fenomena ini memerlukan sistem pengagihan air direka dengan sempurna. Sistem tersebut seharusnya mampu menyediakan kuantiti air yang mencukupi dengan berterusan kepada pengguna pada tekanan yang memadai dan kos rendah. Projek ini adalah dalam usaha untuk merekabentuk sistem pengagihan air untuk rancangan skim perumahan Desa Ilmu Fasa 15, 18, dan 19 di Daerah Samarahan. Sistem ini direka berdasarkan syarat panduan Jabatan Kerja Raya (JKR) Malaysia, seperti yang terkandung dalam buku The Malaysian Water Association (MWA) Design Guidelines for Water Supply Systems (1994). Rangkaian perpaipan dalam projek ini dianalisis menggunakan perisian WaterCAD yang dihapcipta oleh Haestad Methods Inc. USA. Rekaan ini dianalisis dalam tiga scenario yang berlainan iaitu keperluan harian purata, kegunaan puncak seharian, dan keperluan genting semasa kebakaran.

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CHAPTER 1

INTRODUCTION

Everyone knows that water is essential to sustain life. It also plays a central role in the growth and environmental health of cities and towns. We depend on water for more than just drinking, cooking, washing and personal hygiene. Vast quantities are often required for industrial and commercial uses. In some parts of the country like Malaysia, large quantities of water for irrigation are necessary to support agriculture. We also rely on our water sources for power generation, recreation, fish and wildlife conservation, and navigation.

1.1 PROJECT BACKGROUND

This project consists of housing area as stated in Table 1 and the site plan is shown in Figure 1 in page 4.

Project : Desa Ilmu Phase 15, 18, and 19,
Samarahan Land District,
Sarawak

Client : Desa Ilmu Sdn. Bhd.

9th Floor, Wisma Naim,

Lot 2679, Rock Road,

93200 Kuching

Consultant : Jurutera Minsar Consult Sdn. Bhd.

Level 2 & 3, Westmoore House,

Twin Tower Centre, Rock Road,

93200 Kuching, P.O. Box 1872

93738 Kuching, Sarawak

Table 1: Types and Number of Houses

Site	Types of houses	Number of unit
Phase 15	Single storey terrace	116
	Double storey terrace	7
	Single storey semi-detached	52
	Double storey semi-detached	26
Phase 18	Single storey terrace	130
	Double storey terrace	25
	Single storey semi-detached	12
Phase 19	Detached houses	37
	Total	405

1.2 OBJECTIVE

This project concentrates on the water supply used in domestic area. The objective of this project is to design a water reticulation system for the proposed Desa Ilmu Phase 15, 18, and 19 housing scheme at Samarahan Land District which will provide adequate quantities of water for various uses in community and sufficient pressures throughout the system. The design is based on the Jabatan Kerja Raya (JKR) Standards, which was stated in The Malaysian Water Association (WMA) Design Guidelines for Water Supply Systems (1994).

Figure 1: Site Plan

CHAPTER 2

LITERATURE REVIEW

This chapter is a brief description about the water supply system based on JKR Standards. Several elements and stages in water supply system would be briefly explained in the following section in this chapter. Nowadays, elements in water supply system such as pipelines network and water quality are designed and analyzed using computer simulation.

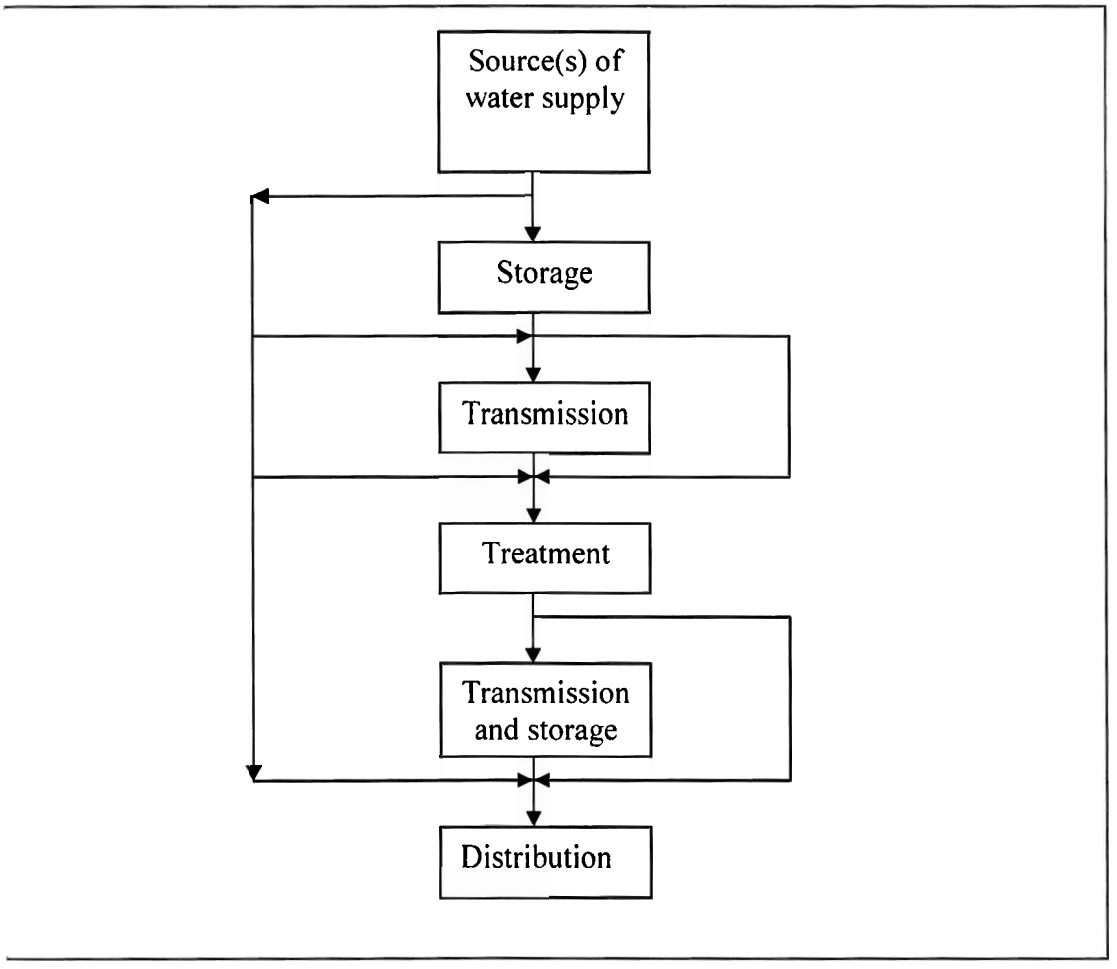
2.1 WATER SUPPLY SYSTEM

According to Ray, K. Linsley et al. (1992), there are several elements in the water supply systems which are consist of:

i. The sources of supply
ii. Storage facilities
iii. Transmission (to treatment) facilities
iv. Treatment facilities
v. Transmission (from treatment) and intermediate storage facilities
vi. Distribution facilities (service area)

The figure below shows the diagrammatic interrelationship of the elements of water supply system.

Figure 2: Interrelationship of the functional elements of a municipal water supply system. [Source: Ray, K. Linsley et al. (1992)]



The design and analysis for this project is concentrating to distribution facilities (service area), where the water is distribute to the individual users connected to the system.

2.2 SOURCES OF WATER

The sources of water determined through the water resources study are:

i. Direct runoff from rivers

ii. Supply from rivers after the development of impounding reservoirs, diversion barrages, and storage reservoirs

iii. Groundwater

iv. Conjunctive use of ground and surface derived water

2.3 PIPE DIAMETER SELECTION

The selection of pipe diameter depends on the following general factors:

i. For gravity systems, the difference in elevation between the source and the point of discharge

ii. For pumping systems, in general, the cost of power needed to deliver the water.

iii. The major frictional losses in transmission, distribution and reticulation pipelines caused by the pipe

iv. The minor frictional losses in transmission, distribution and reticulation pipelines through valves and fittings. Generally, these losses are usually minimal as compared to major friction losses.

All distribution or reticulation network pipes are designed to meet peak demand requirements as well as fire demand requirements, according to the relevant risk category, with average demand taken at all points in the network. For both requirements, the minimum residual heads required shall be met.

2.4 PIPE FRICTION FACTOR

According to the committees of HDR Engineering Inc. (2001), friction in pipes is the effect of pipeline interior changes with time. Friction head loss would increases with the age of pipe. This is because of various physical and chemical characteristics of water that change the finishes or roughness of the interior of pipe. Besides that, the reduction of the interior diameter of pipe due to sedimentation, scaling, organic growth, tuberculation, and corrosion also contribute to the changes.

2.5 WATER SIMULATION PACKAGE AND SOFTWARE

There are many types of water simulation software used to analyzed hydraulic network analysis. Some of those described briefly in the next page.

2.5.1 WATERCAD SOFTWARE

WaterCAD is developed by Haestad Methods and was easy to use and yet gives accurate results. It is a powerful hydraulic analysis tools that enables engineers to analyze water quality simulation and hydraulic networks. The advantages of WaterCAD are not only for experts like engineers, but also for beginners like student. It is good for academic purposes since WaterCAD is simple and has a powerful graphic interface and scenario management tool. This capability can help beginners to relate theory with practical situation by using computer application. WaterCAD can perform steady-state and extended period simulation. The graphic layout is either schematic or scaled. The scenario management tool contains base and child scenario that enables designer to manage many different situations in one time.

2.5.2 PIPE2000 / KYPIPE SOFTWARE

Pipe2000 is seamlessly integrated suite of software which includes the engines KYPIPE, Steam, Gas, Surge, and GoFlow. This software is developed by University of Kentucky. For thirty years, KYPIPE has developed and provided support for pipe system hydraulic flow analysis software. The strength and flexibility of the Pipe2000 suite of engines has made KYPIPE an industry leader and made their software the most widely used pipe system hydraulic flow analysis software in the world. The Pipe2000 suite of software utilizes a consistent, intuitive Graphical User Interface; allowing the user to transition easily and efficiently between engines.

Pipe2000: KYPIPE which utilizes the software engines KYPIPE4, has been an industry standard. This engine is the most widely used and trusted hydraulic analysis engine in the world and has been qualified for nuclear applications. KYPIPE4 provides many capabilities not available with other hydraulic analysis engines.

i. Pipe2000: KYPIPE supports EPANET, a combined hydraulic/water quality engine-modeling package created by the United States Environmental Protection Agency primarily for water quality analysis. EPANET unfortunately does not currently support some of the KYPIPE Graphical User Interface modeling features but does allow hydraulic calculations.

ii. Pipe2000: Hydrant flow calculation in KYPIPE allows users to select hydrants for a fire flow simulation and obtain calculated flow information for a set pressure as printable fire flow graphs or as hydrant reports.

iii. Pipe2000: KYPIPE generates direct parameter calculations as well as pump and system curves.

2.5.3 EPANET/ MIKE NET SOFTWARE

EPANET is a Windows 95/98/NT program developed by BOSS International, USA that performs extended period simulation of hydraulic and water-quality behavior within pressurized pipe networks. A network can consist of pipes, nodes